4.4 Alternative 3

Natural Environment (4.4.1)

EARTH (4.4.1.1)

Analysis of Alternative 3 indicates the area available for timber harvesting is reduced to approximately 5,133 acres. No timber harvesting will occur within 5,580 acres of unstable slope areas and adjacent buffers except for minor removals within the outer 50 feet of the buffer areas for edge feathering. Harvesting on 1,689 acres of potentially unstable slopes will retain at least 50% of the trees. The area in riparian buffers increases to approximately 1,311 acres and the acres of wind buffers increases to approximately 931 acres. The size of the areas identified as potentially inaccessible is reduced to 1,049 acres because some of these areas are included in the buffers described above. Average annual acres harvested are reduced to 29 acres, all of which are either thinnings of young stands or partial cuts of older stands.

About 30 miles of new road will be constructed during the first rotation of 140 years. No road construction will occur on unstable or potentially unstable slopes.

Impacts on Slope Stability

The overall impacts on slope stability would be considerably less than Alternative 1, and less than Alternative 2. No roads would be constructed on unstable slopes and road construction on potentially unstable slopes would be "almost" none. The potential for road construction caused slope failures would be at a very low level of probability.

No harvesting would occur on unstable slopes and only partial cutting, which retained over 50% of the trees, would occur on potentially unstable slopes. This level of harvest would reduce the probability of slope failures due to loss of root strength to a low level as well.

Impacts from rain-on-snow-induced instability due to increases in soil-water would be essentially eliminated since regeneration harvesting would not be occurring.

Impacts on Erosion

Surface erosion from exposed slopes associated with road construction would be further reduced under this alternative due to the reduction by one fourth of the amount of new road construction from Alternative 2 and by one half from Alternative 1. The mitigation described in Alternative 1 is also applicable to this alternative.

Cumulative Impacts

The cumulative impacts from implementation of this alternative would be much reduced from Alternative 1, but would be only minimally different from Alternative 2. Most of the sediment deliverable to public resources would originate from existing roads within the area, and from new roads constructed on private land. These impacts are not significant.

Additional Mitigation Measures

Same as Alternative 2.

Unavoidable Adverse Impacts

Road and landing construction activities would result in short-term increases in sediment production, even if potential impacts were mitigated.

AIR (4.4.1.2)

Climate/Air Quality

Short-term impacts only, similar to Alternative 1. The already low potential for impacts is reduced even further from Alternative 1 and 2 due to reduced level of harvest activities.

WATER (4.4.1.3)

Surface Water Quality

There will be less road construction and reconstruction on potentially unstable slopes under this alternative than under Alternative 2. Therefore the risk of sediment from erosion of roads entering surface waters is less than under Alternative 1 or 2. There is also less chance of destabilizing a potentially unstable slope and increasing the risk of mass wasting.

Buffers along all streams will be wider under this alternative. Because the buffers for Alternative 2 are sufficiently wide enough to provide adequate shade and filtering capacity, there will be no additional benefit to surface water quality.

This alternative prohibits aerial application of chemicals. Consequently the risk of introducing chemicals directly into surface waters is all but eliminated.

Surface Water Quantity

This alternative requires that timber stands older than 60 years will be maintained on 50 percent of forested acres in all sub-basins identified by watershed analysis

(WDNR, 1997a). It is estimated that timber stands in the Lake Whatcom Planning Area attain 95 percent recovery of hydrologic maturity by age 35 (Hudson, 2000). If there are stands present within a sub-basin that are between 40 and 60 years old, the proportion of the sub-basin in a hydrologic mature condition will be greater than 50 percent. Therefore the risk of significantly increasing peak flows associated rain-on-snow events is less than under Alternative 1 or 2. This is especially true for Smith and Olsen Creek. For sub-basins entirely in the rain-dominated zone, the reduction in risk is minimal.

Less timber will be harvested under this alternative because of the hydrologic maturity requirements, the additional buffering and the restrictions on harvest removals on potentially unstable slopes. Water yield will be less than what it would be under Alternative 1 or 2.

Groundwater Quality

There is no further mitigation for groundwater quality under Alternative 3.

Groundwater Quantity

Alternative 3 requires that 140-foot buffers be left on the edges of unstable areas. If harvesting occurs upslope from an unstable area, the buffer may reduce the amount of additional subsurface flow delivered to the unstable area because of the harvest. As the length of the harvested slope is increased the significance of the reduction becomes less.

Public water supply

The risk of sediment and phosphorus loading above natural background levels into Lake Whatcom is slightly less under Alternative 3 than under Alternative 2. Over time, the average water yield delivered to Lake Whatcom will be less than Alternative 1 or 2. However, neither Alternative 1 or 2 are likely to adversely affect the public water supply.

PLANTS AND ANIMALS (4.4.1.4)

Forest Vegetation: Upland, Riparian, and Wetland

(*The forest ecologist did not address locally rare or uncommon native vegetative communities since she has no information about what's there. This could be addressed in the DEIS.)* .

Upland Vegetation: General Forest Ecology Perspective

In the short-term, changes to the forest will occur primarily in stands harvested during the first decade. Twenty-five percent of the basal area would be left on

harvested units. Requirements for maintaining fifty percent of the acres of each sub-basin in a hydrologically mature state would result in older stands in some areas during the first decade. A higher percentage of the forest would be protected in buffers than in Alternative 1. At the end of the first decade, eleven percent more of the forest would be in the upper two age classes and eleven percent less would be in the lower age classes. Existing snags and down logs would be retained in harvested areas where possible, resulting in a legacy of decomposing wood on harvested units.

Because harvest would consist of heavy thinning rather than regeneration harvests, structural diversity in harvested areas would increase compared to Alternative 1. The potential for maintaining half of each harvested sub-basin in older stand ages could also contribute to structural diversity within sub-basins. Buffers within older stands might begin to exhibit more mature forest characteristics, such as canopy gaps, layered structure, snags and down logs.

By fifty years, the ratios of stand development stages would be quite different from those of Alternative 1. Less than a tenth of one percent of the planning area would be within the younger age classes, and that area would all be in the pole stand condition. Of the remaining area, 86% would be in the complex stand condition, and 5% of that would be in the fully functional category. At 100 years, approximately 96% of the planning area would be in the complex category, and of this area, 61% would be in the fully functional category.

Mature forest characteristics would be developing in many buffer areas, and the structural diversity of the forest would have increased over the whole planning area due to the retention of many leave trees, and the fact that so much of the planning unit would be now in the older-stand age categories. This would result in more canopy gaps, a more layered canopy, greater diversity of understory and tree species, and a richer legacy of snags and down logs than would exist in the same time frame with Alternative 1.

Short- and Long-term Impacts: Direct and Indirect

No significant adverse impacts are expected from the forest ecology perspective.

Cumulative Impacts

Frequency of entry into the stands would decrease by approximately 50% in the planning unit compared to Alternative 1, with an attending reduction in harmful cumulative impacts (i.e., potential soil compaction and disturbance; road impacts including reduction of forest area, increase in forest edge, sediment inputs and reduction of thermal cover for streams and wetlands).

Additional Mitigation Measures

Mitigation for possible impacts under Alternative 3 would be the same as for Alternative 2, though on a smaller scale as there would be fewer impacts to mitigate.

Unavoidable Adverse Impacts

Unavoidable adverse impacts under Alternative 3 result from the construction of about 30 miles of new road, which removes vegetative cover, fragments forest stands, and increases human disturbance. This is half the distance of road that would be constructed under Alternative 1.

Riparian and Wetland Vegetation: General Forest Ecology Perspective

The addition of substantial buffers on all streams and wetlands over ¼ acre, and clumping leave trees around smaller wetlands would provide protection to those riparian areas and wetlands on timber sale units that are harvested within the first decade. Restrictions on yarding across streams and construction of stream crossings would further protect wetland and riparian soils and vegetation from mechanical disturbance.

Indirect short term- benefits could be significant for those type 5 streams and wetlands over ¼ of an acre that occur on timber sales harvested in the first decade, and possibly for some streams and wetlands downslope of unstable areas where timber harvest is occurring. Buffering of headwater streams could affect water temperatures not only in the affected streams but also downstream in the aquatic system. More substantial buffers could also result in less sediment transport, because soils and hydrology would be protected from short-term disturbance. Restrictions on yarding and construction of new crossings on streams could also prevent the delivery of sediment into the downstream system. A reduction in soil disturbance adjacent to streams and wetlands might prevent impacts to subsurface flow and channel morphology. Maintaining vegetation in riparian and wetland management zones could also help to maintain hydrology by maintaining evapotranspiration adjacent to the stream or wetland.

Over the longer term, in the buffers of many streams and riparian areas, large trees would be established in 50 to 100 years. Since these buffers are wider, this would result in larger down wood inputs into wetlands and streams, and a more diverse riparian understory.

With a more mature overstory in wetland and stream buffers, thermal and evapotranspiration relationships would be more stable, large down logs would exert influence on flow direction and provide sites for tree and shrub regeneration, and a more diverse riparian understory would create habitat for a greater number

of creatures which in turn would assist in seed and spore dispersal and decomposition.

Short- and Long-Term Impacts: Direct & Indirect

No significant adverse impacts are expected from the forest ecology perspective.

Cumulative Impacts

The potential for cumulative impacts to wetlands and riparian areas would be reduced from the levels expected for Alternative 1, for those wetlands and streams that receive buffers, and those wetlands smaller than ¼ of an acre that are recognized and protected by leave tree clumps. For small, unidentified wetlands, reducing the frequency of entry through longer rotations could lessen cumulative impacts.

Additional Mitigation Measures

Mitigation for impacts to small wetlands is the same as for Alternative1, and should ideally be accomplished through avoidance. Effort must be made whenever possible to locate wetlands that are too small to show up on aerial photos (generally wetlands under .25 acres). This can sometimes be accomplished by looking at soil maps and topographical maps for clues to potential hydric soils and topography, and verifying conditions on the ground.

Unavoidable Adverse Impacts

In spite of efforts to avoid impacts to small wetlands, some are still likely to defy detection and suffer impacts due to timber harvest activities.

Forest Health: Insects and Disease

Alternative 3 has less land accessible for commercial activity, a longer rotation age, and more retention requirements for harvest units than the previous Alternatives.

Short- and Long-term Impacts: Direct and Indirect

This may indirectly reduce commercial productivity and options by preventing aggressive treatments to improve stand vigor and reduce structures that are conducive to forest insect and disease activity. The ecosystem is not threatened. Snags, logs, and old forest structures will increase over time. General tree age, the proportion of shade-tolerant conifers and late seral structures will increase, increasing risk of activity from forest insects such as

hemlock looper, Douglas-fir beetle, hemlock dwarf mistletoe, and heart-rotting fungi.

On managed sites, with approximately 30 acres treated per year (and virtually no regeneration harvest), the retention requirements for buffers and unstable slopes plus the requirement to permanently retain 25% of the trees in any harvest unit, could be detrimental to commercial productivity by preventing aggressive efforts to change forest structure or composition or remove diseased individuals. Over time, stands will shift toward late seral conditions, becoming more prone to insect and disease activity.

Alternative 3 mentions that retention of all existing snags will be emphasized, where safe and practicable. Snag and hazard tree removal will be necessary around places people recreate in order to ensure their safety and avoid liability to the Department.

Cumulative Impacts

Alternative 3 has very little capacity for land managers to prevent and respond to pest activity due to low active management in general and the prohibition of aerially applied forest chemicals. It has a higher probability that adverse negative indirect effects could result on adjacent lands than Alternatives 1 and 2. However, there is a low probability of these cumulative impacts occurring.

Additional Mitigation Measures

Alternative 3 seeks to protect riparian, aquatic and wetland ecosystems through forbidding the use of aerially applied chemicals. Chemical pesticides are seldom used in forest situations for insect and disease control. Biological pesticides are more frequently chosen to provide a more precise impact to the targeted organism. However, if the resource to be protected (vegetation, forest products, habitat) is seriously threatened, aerial application of chemical pesticides in the Lake Whatcom landscape could be an effective, economical, management option. Chemicals, particularly when they are applied by air, are highly regulated in order to protect riparian, aquatic, and wetland water quality and function. Other mitigation methods (buffers, timing, precision application methods) could be implemented simultaneously as needed to protect the riparian, aquatic and wetland ecosystems that are so critical. The lack of opportunity to use aerial application methods will greatly increase the costs and reduce the efficacy of such a treatment, if it is needed. Direct treatment of forest insects or diseases is less likely to occur under such a scenario and valuable structures such as high value commercial forest products, mature trees, or special habitats may be lost.

In the most extreme potential case of an aggressive, exotic pest being detected in the Lake Whatcom landscape, not unlikely due to proximity to Bellingham

and Vancouver Ports, the Washington State Department of Agriculture could obtain legal access and use aerially-applied chemical tools in this watershed regardless of local preferences or policy. Therefore this restriction potentially adds expense and may threaten some vegetation or habitat resources, but risk to the larger ecosystem could likely be avoided.

Short of the extreme case of an ecosystem-threatening exotic species that the WSDA will take the lead in controlling, perhaps the Lake Whatcom plan could include a provision for emergency rule-making or management actions in the event of a significant disturbance such as fire, landslides, or insect outbreaks which threaten significant resources and the agreed-upon objectives. The intent would not be to frivolously suspend the rules; but to make prudent decisions when faced with specific, time-sensitive problems.

Unavoidable Adverse Impacts
None identified.

Rare and Sensitive Plants

Same as Alternative 2.

Animals *Habitat Availability (quality, quantity, accessibility)*

The same species-by-species protection identified under Alternative 1 applies to Alternative 2 through 4.

Short-term, Long-term, Cumulative Impacts

Alternative 3 would decrease the short-term direct and indirect impacts listed under Alternative 1 even more than Alternative 2 would, as a substantially larger area of the planning area would be restricted from harvest and/or road-building activities. This would result in similar comparisons for long-term impacts, as well, which benefit interior old-forest species but reduce habitat for species using young forest and edge habitats.

Another significant difference under Alternative 3 (short-term and long-term), compared to Alternative 1, would be the requirement to incorporate WDFW PHS management guidelines for all wildlife species that have such guidelines. The requirement to inventory all existing suitable habitat would involve a considerable resource commitment, particularly for northern goshawks and pileated woodpeckers, with unknown or potentially little "return" for the effort. Inventorying all suitable habitat that may be considered for management activities may be more efficient and effective.

Other significant differences under Alternative 3 (vs. Alternative 1) that have both short-term and long-term ramifications for wildlife include additional

buffers for unstable slopes, further limitations to harvesting and road-building in other areas, significantly increased buffers for riparian areas and wetlands, and increased snag and leave tree retention. These, in addition to the long-term impact of increasing the average rotation age from 60 to 140 years, would result in the cumulative positive impact of creating even larger blocks of forest that would have no (or limited) harvesting, particularly for the next 60-70 years. Compared to Alternative 1, Alternative 3 would most notably maintain unroaded, contiguous forest habitat in the eastern (mid) and southwestern portions of the planning area, with a considerable reduction in new roads in the southeastern portion, as well. Compared to Alternative 2, the differences for Alternative 3 would be most prominent in the middle-western portion (Lookout Mountain).

Alternative 3 allows partial cuts or thinnings[1], particularly in dense stands, in order to capture revenue that would otherwise be lost. Such partial cuts would have the potential to accelerate stand structure diversity within some stands that are currently in a mid-seral stage ("pole" or "closed"). Silvicultural treatments could be used to develop stand characteristics more typical of later seral stages (i.e., "complex"), such as canopy gaps, heterogeneous understory vegetation, canopy layering, and larger-diameter trees. However, due to some of the constraints outlined in other portions of this alternative (particularly related to activities on "potentially unstable slopes" and riparian buffers), and the resulting increase in "potentially inaccessible areas", it would not be likely that many of these treatments could realistically be conducted. This could be considered an indirect effect of Alternative 3.

The increase in buffers would likely result in an even greater increase in the development of snags and downed wood over the landscape. The increased snag and leave tree retention proposed under Alternative 3 could potentially have a profound effect on cavity-nesting species (i.e., Life Forms 13 and 14), as well as other birds and the Keen's Myotis. The actual difference that would be realized on the ground would depend on further specifications regarding *what* would be retained and *how*. As it is currently written for the alternative (25% retention by basal area), it would be possible for a large number of small-diameter trees to be retained, as there is no minimum diameter stated. Regardless, it could result in a significantly larger amount of leave trees. Depending on their distribution (evenly scattered or clumped), this could result in fewer large openings, and could therefore also affect ground vegetation. All of this could have a positive impact for many wildlife species, although it could negatively impact species that use early seral stages and/or "edge" habitat.

[1] Clearcutting is also "allowed" but 25% of the trees by basal area must be retained, which may actually be more similar to a heavy partial cut or partial cuts with "gaps" left due to clumping. So the acres that would actually be clearcut is not known.

The long-term shift in seral stages on the landscape would likely be more pronounced for Alternative 3 than for Alternative 2. Alternative 3 would have less distribution across the seral stage classes, and more concentration in the late-seral stages. There would be even fewer stands in the earlier seral stages, with nothing representing the "open" or "regeneration" stage after approximately 50 years (aside from a small percentage of stands in the shrub/sapling subset of the "open" stage for a brief period after approximately 100 years). Smaller within-stand openings would begin to appear in the mature stands as the mechanics of wind and disease affect the forest, but they function differently than stand-size openings. A significant difference between Alternative 1 and Alternative 3 would be observable after 50 years, particularly in the "pole" stage (22% in Alternative 1, 2% in Alternative 3) and the "complex" stage (26% in Alternative 1, 46% in Alternative 3).

Mature forest would increase on the landscape at a faster rate and by a larger amount (than with Alternative 1 or 2), with almost another 25% of the planning area being in the "complex" stage after approximately 100 years, compared to Alternative 2, and 30% more in that stage than in Alternative 1. After approximately 200 years, the landscape would have twice as much "old-growth" or "fully functional" stage than it would have under Alternative 1, and even half again as much as it would under Alternative 2.

Changes in suitable and primary habitat for the analysis species is shown below:

Table 18: Habitat Change under Alternative 3 Relative to Selected Life Forms.

Life Form	Habitat Type[2]	2001	2005	2010	2050	2100	2150	2200
8	Suitable	59	65	63	51	52	50	50
	Primary	30	33	28	2	3	1	1
10	Suitable	86	92	93	100	98	100	100
	Primary	84	86	88	100	97	100	100
11	Suitable	92	93	94	100	98	100	100
	Primary	84	86	88	100	97	100	100
13	Suitable	72	78	84	99	97	99	100
	Primary	58	65	70	98	97	99	99
14	Suitable	79	83	85	99	98	99	100
	Primary	58	65	70	98	97	99	99

[2] **Primary habitat** - A preferred or optimal habitat that predictably supports the highest population density of a species; that habitat upon which a species is essentially dependent for long-term population maintenance.**Secondary habitat** – A habitat that is used by a species, but is clearly less suitable than primary habitat, as indicated by a lower population density or less frequent use. A habitat may be designated as secondary where it is known to be used by a species but data are insufficient to clearly identify it as a primary habitat.

Under Alternative 3, Life Form 8 would actually experience a short-term increase in suitable habitat (from 59% to 63%) and a short-term decrease in primary habitat (from 30% to 28%). The long-term trend for Life Form 8 would be even more of a decrease in habitats than with Alternative 2 (from 59/30% to 50/1%), as opposed to a long-term increase under Alternative 1 (to 64/32%).

Life Forms 10 and 11 are predicted to have a short-term increase in habitats (from 86/84% to 93/88%, and from 92/84% to 94/88%, respectively). This contrasts with a short-term decrease for both under Alternatives 1 and 2. After approximately 200 years, these life forms are expected to have 100% of the landscape in both suitable and primary habitat (with an absence of less-used "secondary" habitat).

Habitat for Life Forms 13 and 14 is also expected to show a greater short-term increase (from 72/58% to 84/70%, and from 79/58% to 85/70%, respectively) under Alternative 3 than Alternatives 1 and 2, especially compared to the only slight increase with Alternative 2. Long-term trends for Life Forms 13 and 14 are expected to reach 100% suitable and 99% primary habitat on the landscape. This is considerably more than the predicted amount for Alternative 1 (79/64% for Life Form 13 and 82/64% for Life Form 14).

In summary, there is a probable, significant adverse impact to species who rely on younger forest habitat, such as Life Form 8. Their primary habitat begins to decrease in the short-term and almost disappears in the long-term. However, it increases benefits to species using interior old forest.

Additional Mitigation Measures

Alternative 3 provides a variety of protective measures for wildlife and wildlife habitat. The increased responsibility to inventory and protect suitable habitat according to PHS guidelines has the potential to more adequately protect and/or mitigate impacts to species that are difficult to detect without surveying (such as the northern goshawk and pileated woodpecker). The increased buffers required under this alternative have the potential to mitigate impacts to amphibians, including the tailed frog.

[Additional work under the DEIS will be to determine and discuss "real" impact/benefit/mitigation compared to Alt. 2 for the larger buffers on type 1-4 – most likely noticeable difference primarily w/ type 3 and type 5 streams, though 140' wind buffers on ALL streams in wind-prone areas is also a quite significant addition! Still need to review literature on amphibian studies w/ varying buffer widths, and may determine these to exceed the needs of these species. May also compare w/ needs for interior forest species.]

Unavoidable Adverse Impacts

Unavoidable adverse impacts would include those listed for Alternatives 1 and 2, but most would likely be to a much lesser degree. This is primarily due to the fact that it would result in much less habitat fragmentation and would impact fewer unroaded areas.

Fish

Habitat Quality

Alternative 3 is more protective of riparian ecosystem functions than either Alternatives 1 or 2. It provides wider RMZs on all water types, provides careful regulation of timber harvest and road construction on potentially unstable slopes. Alternative 3 should maintain a high level of riparian function, and protect the stream channel from sedimentation caused by upslope landslide failures.

This alternative is more protective of riparian ecosystem function than Alternatives 1 and 2, because it does not allow harvest in an RMZ, except for roads and yarding corridors. At the same time, because there is no silvicultural management within these RMZs, this may slow the recovery of some riparian ecosystems. Management, in the form of thinnings and tree species conversions, could hasten recovery of large diameter conifer trees, a desirable characteristic of "older forest conditions".

The wider wind buffer under Alternative 3 will further reduce potential damage to the inner part of the RMZ, and the harvest allowed in the outer 50 feet of the wind buffer may make the RMZ more wind resistant.

Short- and Long-term Impacts: Direct and Indirect

No probable, significant adverse impacts are identified. Alternative 3 will increase protection to riparian function and in-stream fish habitat.

Cumulative Impacts; Additional Mitigation Measures

Same as Alternative 1 and 2.

Unavoidable Adverse Impacts

Same as Alternative 1 and 2.

Habitat Accessibility

Habitat will remain accessible to all native fish species, at all life stages. All fish-blocking culverts will be repaired with fish-passage structures, and replacement will occur during planned management activities or during implementation of the Road Maintenance and Abandonment Plan.

ENERGY AND NATURAL RESOURCES (4.4.1.5)

Energy Resources

The only change in this alternative from Alternative 2 is not allowing surface drilling, which has been the current policy for new leases in the watershed. Therefore, there is no change from Alternative 2. If a state parcel is inaccessible by underground drilling, then the lease application will essentially be denied.

As previously noted, some DNR parcels have a severed mineral estate; DNR cannot control exploration activity in those parcels within the watershed.

Mineral Resources

There is no change from Alternative 2 in this alternative.

Forest Resources

Timber Resources

Alternative 3 provides 33 percent of the project area available to harvest. The annual harvest is less than 10 percent of Alternative 1. Almost no true regeneration harvest will occur on state trust lands under Alternative 3, due to the requirement for 25 percent retention of trees in each harvest unit. However, some of these trees may be clumped for either habitat or operational reasons, resulting in some small clearcuts.

Short-term Impacts: Direct and Indirect

The immediate ability to begin harvest operations will be delayed until sufficient acreage and volume is available to cover costs of logging, new road construction, reconstruction, layout and administration costs. Very poor access and limitations on regeneration harvests limit options for logging equipment. Increasing retention levels increases all operational costs because of higher complexity to sale layout and logging, costlier logging methods, and higher levels of road construction. (Burns, et. al., 1983.) Some areas would be inaccessible to harvest, as landings suitable to helicopter operations would not be available. Thinnings in helicopter terrain may also not be economically feasible.

Long-term Impacts: Direct and Indirect

Average rotations of 140 are required under this alternative. Delays in the extraction of timber are expected until trees reach rotation age of 140. A high reduction in average site index for lands available for harvest will occur with subsequent reductions in yields per acre. Also, the volume of retention trees will increase shade, favoring shade-tolerant species Stands dominant with Douglas-fir will diminish over time and be replaced with higher levels of hemlock and cedar.. With fewer openings to favor alder and active conversion from alder to conifer, the availability of red alder of commercial size will decrease over time.

Higher levels of retention offer an opportunity to produce larger trees with higher quality wood characteristics than those managed on shorter rotations. In order to extract value from larger wood, equipment capable of removing the logs will have to be larger with subsequent higher logging costs. Current manufacturing processes and wood products design have been encouraging utilization of small dimension logs by local mills in the region. The financial value of larger and higher quality logs may be offset by the costs of hauling wood to mills that have not been retooled for smaller wood.

Cumulative Impacts

Table 17 (repeated): Timber Resources - Cumulative impacts of each alternative. (Same as Table 7 & 14.)

	Alternative 1	Alternative 2	**Alternative 3**	Alternative 4	Alternative 5
Available acres for harvest or restoration activities	11,222	8,016	5,133	3,740	2,044
Percent of 15,657-acre planning area	72	51	33	24	13
Draft average annual harvest per decade (mbf/year)	5,511	2,733	492	428	N/A
Draft average Harvest Volume (mbf/acre)	37	30	9	16	N/A
Draft annual acreage treated as regeneration harvests	89	43	0	0	N/A
Draft average annual acreage treated as thinning harvests	47	35	18	16	N/A
Draft annual average acreage treated as partial cut harvests	11	13	11	9	N/A

Additional Mitigation Measures

Mitigation to the Trusts for reduced availability of this commercial resource could come through alternative revenue sources. However, a great deal of uncertainty still surround these. This would not provide any relief to the local economies linked to the forest industry or local and national wood supply.

Unavoidable Adverse Impacts
None identified.

Special Forest Products

Short-term Impacts: Direct and Indirect

Alternative 3 limits vehicular access to large portions of the project area and with moderate impacts to the ability to economically harvest special forest products.

Long-term Impacts: Direct and Indirect

Vegetation more tolerant of shade and in older forests will be favored by this alternative. Products needing full sunlight and open areas may not be available in sufficient quantities. Quality and quantity of moss is likely to increase. Fungal species needing maintenance of deeper, undisturbed layers of organic matter and would be favored by this alternative.

Possible conflicts with Native American traditional uses of medicinal plants may impact any commercial harvesting.

Cumulative Impacts
No probable significant adverse cumulative impacts identified.

Additional Mitigation Measures
Same as Alternative 1.

Unavoidable Adverse Impacts
None identified at this time.

<u>Conservation/Preservation</u> (carbon sequestration)

Same as Alternative 1.

Built Environment (4.4.2)

ENVIRONMENTAL HEALTH (4.4.2.1)

Release of Toxics/Hazardous Materials

No significant adverse impacts likely.

Risk of Explosion/Fires

The risk of explosion, which is low, is unchanged compared to Alternative 1. However, reduced harvest activity could result in additional forest density, which can be associated with greater risk of forest disease and insect damage. These conditions could increase fuels in the forest though they would not in themselves increase the risk of fire starts. The risk of human-caused fires is likely to be similar to or even further reduced from the level anticipated in Alternatives 1 and 2, since reduced harvest activity and the related reduction in roads would most likely result in similar or lower dispersed recreational use levels and patterns.

Risk of Slides, Floods, Debris Flows

Short-term Impacts: Direct and Indirect

The potential for short-term impacts to the built environment under Alternative 3, like Alternative 1 and 2, is minimal. The potential for damage to roads is reduced, since there would be fewer new roads associated with unstable or potentially unstable slopes.

Long-term Impacts: Direct and Indirect

Similar to Alternative 1. Damage to new roads would be reduced from Alternative 1, and somewhat reduced from Alternative 2 because no new roads are proposed for unstable slopes and most potentially unstable slopes.

Cumulative Impacts

Similar to Alternative 2, but with slightly reduced cost of reconstructing roads.

Additional Mitigation Measures

Same as Alternative 1.

Unavoidable Adverse Impacts

Same as Alternative 1.

Spiritual & Emotional Health

No known impacts. See "Affected Environment" discussion.

LAND & SHORELINE USE (4.4.2.2)

Existing Land Use Plans/Growth Estimates

The risk of explosion is unchanged compared to Alternative 1. However, reduced harvest activity could result in additional forest density, which can be associated with greater risk of forest disease and insect damage. These conditions could increase fuels in the forest though they would not in themselves increase the risk of fire starts. The risk of human caused fires is likely to be similar to the level anticipated in Alternative 1, since reduced harvest activity and the related reduction in roads would most likely result in similar or lower dispersed recreational use levels and patterns.

Residential and Commercial Development

No Change from Alternative 1.

Aesthetics

All five alternatives include an objective to "reduce the visual impact of forest management activities in high visibility areas as shown on Map S-1" (See Appendix C.) In addition, many citizens raised the question of visual impacts in their scoping comments. This analysis looks primarily at those areas identified as having "high" and "medium" potential for visual impacts as viewed from six different residential communities.

Short-term and Long-term Impacts: Direct

Visual impacts under Alternative 3 should be less than Alternative 1 or 2 due to increased buffers (streams, unstable slopes and wetlands), more areas restricted from harvest or limited to thinning, and the requirement for more forest acres to be hydrologically mature in each sub-basin. These patterns will tend to increase the visual complexity of the landscape and create more naturally shaped edges than in Alternative 1 or 2. This is generally true across the landscape except for the area north of Smith Creek on Map S-1. Wind buffers will increase the visual softening influence of riparian buffers, but otherwise patterns will be similar to Alternative 1 and 2 in that area.

Alternative 3 also results in fewer new roads and quicker abandonment of existing roads. Although not considered a significant element under Alternative 1 and 2, it would be even less of an issue under Alternative 3.

Cumulative Impacts
Minimal, if at all.

Additional Mitigation Measures

Sale design strategies could be used in the area north of Smith Creek to soften the visual impacts of harvest areas.

Unavoidable Adverse Impacts

This analysis assumes there will be no significant adverse impacts, particularly if mitigation actions noted above are used. Because aesthetics are subjective, not objective, it is difficult to say that no one will experience what they consider significant impacts. The likelihood, however, is reduced under Alternative 3.

Recreation

All the alternatives are based on an objective to "manage dispersed, low impact recreation.

Short- and Long-term Impacts: Direct

Access throughout the area by recreational users (horse rider, hiker, mountain biker) will likely be further diminished due to the abandonment existing roads and/or the reduced amount of new roads.

With larger areas that are not harvested for timber, there will be less evidence of human impact. For most users this would be an enhancement of their recreational experience. With fewer open areas, there may be reduced berry-picking opportunities.

As there are fewer roads in the forest that are available for recreation users, access may be become more limited and users may be more concentrated on fewer trails or roads. For example, equestrians utilize existing and abandoned roads as well as unsanctioned trails. Use of the roads is year-round while trail use is generally during summer months when the soils are not as saturated. If there are fewer roads, then equestrian use may possibly become more concentrated, especially during the winter.

The amount of enforcement, particularly to discourage off-road vehicle use is not expected to increase since access to major forest road systems are currently blocked by gates in cooperation with other major landowners.

Short- and Long-term Impacts: Indirect
None identified.

Cumulative Impacts
None identified.

Additional Mitigation Measures
None identified.

Unavoidable Adverse Impacts
None identified.

Historic & Cultural Preservation

Alternative 3 is basically the same as Alternatives 1 and 2. However, full establishment of the cultural resources program is likely to move forward more quickly because this alternative commits the department to developing a Cultural Resource Management Plan with the affected Tribes within 1 year of adopting the landscape plan.

Alternative 3 also references Lummi Tribal codes and resolutions. Due to constitutional, statutory, regulatory and case law constraints, this portion of Alternative 3 could not be implemented in the Lake Whatcom watershed.

Additional cultural resource properties would be incidentally protected through increased natural resource preservation. (See the table provided under Alternative 1.)

Agriculture

No change from Alternative 1.

Silviculture

Under this alternative, approximately one third of the project area will be eligible for commercial harvest. Choices of silvicultural systems are reduced.

Short-term Impacts: Direct and Indirect

Regeneration of stands will continue to emphasize current practices of artificial regeneration of Douglas-fir and western red cedar. Planting densities will be reduced slightly. Natural seeding will be utilized at higher elevations.

Aggressive brush control will occur during the first ten years. The alternative disallows the use of aerial applied pesticides or fertilizers. Manual chemical treatments would be permissible under this scenario and could be employed for the more difficult brush species that are better controlled with aerially applied herbicides. This would result in moderate to high cost increases.

Long-term Impacts: Direct and Indirect

Studies show that reductions in the growth of DF show significant impacts where retention moves above 20% (Brandeis, et. al. 2000). Some loss of conifer growth will occur as problem species that are not readily controlled by manual means out compete conifer species. An increase in tolerant species will be favored.

All stands should be eligible for precommercial thinning. This alternative appears to have the most area harvested by helicopter, which will increase costs of all silvicultural activities.

Cumulative Impacts

The ability to control stand structure, stand composition and density, control rotation length, facilitate harvesting, and maximize timber yields are reduced compared with Alternative 1.

Additional Mitigation Measures

After a review of each site, the department selects from the following methods for controlling vegetation: no treatment, non-herbicide, ground-applied herbicide, and aerial applied herbicide. A method lower on the list may be used only if it substantially outperforms other methods (Forest Resource Plan Policy # 33).

Species and sizes of trees that have low survival rates in shaded areas could be increased through aggregated, rather than dispersed patterns of retention.

Unavoidable Adverse Impacts

The potential environmental impacts of various silvicultural approaches are covered under the "Natural Environment" topics. Since these alternatives are policy issues, none of the limitations on silvicultural tools are unavoidable.

TRANSPORTATION (4.4.2.3)

Transportation Systems

Since the harvest rotation is increased from 60 to140 years, road construction should be spread out over a longer period, as well. If construction occurs evenly over the 140 years, there would be about 2 miles of new roads built in the first decade.

Approximately 30 miles of new road would be constructed overall to complete the road system. The combination of log and rock haul would result in an average of 2 truck trips per day generated by forest management activities on DNR lands in the watershed. This number reflects two passes for each truck on a round trip and assumes that work occurs every Monday through Friday.

In addition to the mitigation measures listed for Alternative 2, almost no new roads are allowed on potentially unstable slopes, and no new roads are allowed on unstable slopes under this alternative. Roads in these locations often need more frequent maintenance. This alternative would reduce the amount of maintenance work required.

Short-and Long-term Impacts; Cumulative Effects

Possible environmental impacts are discussed in other sections under "Natural Environment". No significant impacts are expected related to maintenance or traffic. Alternative 2 may result in a less efficient road system and may limit DNR's ability to access some areas by vehicles for harvest (impacting the trust revenues), immediate fire suppression, and recreational users.

This alternative would impact neighboring landowners' ability to access their land since the restrictions on road construction would apply to roads built under easements.

Additional Mitigation Measures

None identified.

Unavoidable Adverse Impacts

Adverse impacts would be similar to Alternative 1 and 2 but proportionally smaller due to the shorter length of road construction.

Forest Road Maintenance and Abandonment Plans

The timeline for completing the Road Maintenance and Abandonment Plan is the same as Alternative 2, but this alternative specifies that all high hazard roads,

including orphaned roads, must be treated within 3 years. The shorter timeline for abandonment and road improvements would reduce the potential for road damage or failure, compared to Alternatives 1 and 2.

Short-term Impacts: Direct and Indirect

Since the deadline for treating low to moderate hazard roads is 2015 and treatment of high hazard roads may take three years to be completed, potential exists for damage or failure of roads due to events that occur prior to maintenance or abandonment of those roads.

Long-term Impacts: Direct and Indirect
None identified

Cumulative Impacts
None identified.

Additional Mitigation Measures

Maintenance or abandonment work identified by the RMAP could be completed sooner than 2015 to reduce the potential for damage or failure due to problems found in the assessment stage.

Unavoidable Adverse Impacts
None identified.

Traffic Hazards/Safety

The amount of hauling under Alternative 3 is far less than Alternative 1 or 2 (averaged out at 2/day for comparison, although hauling events will tend to be more concentrated based on specific road building and harvest activities.). No significant adverse impacts relative to traffic and safety are expected.

Water, Rail and Air Traffic

No significant change from Alternative 1. In Alternatives 3, 4 and 5, timber harvest would reduced significantly and would likely result in less utilization of helicopter logging on DNR-managed lands.

PUBLIC SERVICES & UTILITIES (4.4.2.4)

Relation to Trust Income

Alternative 3 dedicates about 90 percent of the land's productive capacity for ecological and social benefits (Hulsey, 2002). For the percent of acres constrained

relative to timber harvest for each trust under each alternative, see the graph under "Relation to Trust Income" in Alternative 1.

A financial analysis of the preliminary draft sustainable harvest calculations for Lake Whatcom suggests that, in present value terms, Alternative 3 will return between $1,347,000 per year and $1,458,000 per year less than Alternative 1 (to the state general fund for public services and the direct support of county junior taxing districts, and the department's management fund), depending on the annual real discount rate (which ranged from 4% to 10% in the analysis (Glass, 2002).[3]

Analysis was completed for carbon sequestration, green certification and recreation leasing:

Carbon sequestration: Based on the assumptions of this comparative analysis, the breakeven values of additional carbon sequestered under Alternative 3 are likely to be very high compared with deliberately planting bare land for carbon sequestration purposes. This prospect means returns for carbon sequestered in the Lake Whatcom landscape (if any) would probably not produce revenues sufficient to financially justify this choice, since other means of producing carbon for sequestration are likely to be available at substantially lower cost (Glass, 2002).

Green certification: Whether or not certified lumber products attract a premium price in the market, any price premium associated with certified softwood lumber would have to return at least $1,369/mbf to the forest grower, in order to financially justify choosing Alternative 3 over Alternative 1, because of the greatly reduced timber harvest. It appears highly unlikely that price premiums of this magnitude will be realized by the forest grower, especially in the context of current lumber and stumpage prices. (Glass, 2002).

Recreation leasing: None of the alternatives proposes a destination resort on state trust lands near the shores of Lake Whatcom. However, because this would generate some of the highest recreation returns, it was used as a test case, to see if recreation income could effectively offset reductions in timber revenues. Estimated lease revenues from a hypothesized destination resort development on the shores of Lake Whatcom are unlikely to completely offset timber harvest revenues forgone under Alternative 3. (Glass, 2002).

Finally, it appears highly unlikely that combined revenues from carbon sequestration, certified lumber production, and leasing of trust land for recreation activities could financially justify the choice of Alternative 3 over Alternative 1 (Glass, 2002)

[3] These results include only timber revenues captured by the department, and are based on an analysis that assumed the services of the land were obtained for no cost. Therefore the results should be interpreted as a financial analysis rather than either an economic or benefit-cost analysis.

Fire

No change from Alternative 1 as to fire risk. Reduced income could affect the amount distributed to local fire districts from harvests on Forest Board lands

Police

No change from Alternative 1.

Schools

Reduced timber harvest level would result in a lower level of contribution to the Common School Construction Account and reduced revenue to the state general fund, which could reduce the amount of legislative funding available for other education related needs.

Parks & Recreation facilities

Same as Alternative 1.

Communications

No change from Alternative 1. The DNR will continue to lease communication tower and building space to interested parties, will increase rental rates when market conditions allow and will seek new customers.

Water/Storm Water Management

Not Applicable

Sewer/Solid Waste Management

No change from Alternative 1.

Other Government Services or Utilities

Not applicable.